4-1-1974

A Descriptive Analysis of the Application of the Eastern Nebraska Community Office of Retardation (ENCOR) Language Lattice to Precision Teaching by Three ENCOR Teachers

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A DESCRIPTIVE ANALYSIS OF THE APPLICATION OF THE EASTERN NEBRASKA COMMUNITY OFFICE OF RETARDATION (ENCOR) LANGUAGE LATTICE TO PRECISION TEACHING BY THREE ENCOR TEACHERS

A Thesis

Presented to the

Department of Special Education

and the

Faculty of the Graduate College

University of Nebraska at Omaha

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

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April, 1974

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ACKNOWLEDGEMENTS

The writer sincerely acknowledges the suggestions and assistence rendered by the following members of the Thesis Committee: Dr. James Wood, Chairman, Dr. Joseph Dunn, Dr. Roger Harvey, and Dr. Lawrence Hilton, under whose supervision this study was completed.

Special appreciation is extended to the Eastern Nebraska Community Office of Retardation (ENCOR) who supplied the subjects for this study, and to the three ENCOR teachers for their cooperation. This writer wishes to acknowledge the speech clinicians who wrote the ENCOR Language Lattice: Kay Galloway, Sue Babendure, Bobbie Salser, Robert Portnoy, Mike Barker, and Ruth Whitney. Dr. Charles Galloway, Karen Faison, and Linda Esterling, also of ENCOR, provided much appreciated assistence.

To Judy Tomlinson for her technical assistence and typing of this thesis and to my fiance', Gary Aron, for his suggestions and encouragement a final word of appreciation is extended.

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Chapter 1

INTRODUCTION

Eastern Nebraska Community Office of Retardation (ENCOR) Developmental Centers serve those retarded children who have not been accepted into public schools because they are too young or do not have required skills. A primary goal of Centers' staff is to help each child develop as much as possible and as rapidly as possible. Another goal is to place children in public schools.

One area of training in Centers is language development. ENCOR speech clinicians have designed a language lattice as a guide to ENCOR teachers. The lattice includes steps necessary to train a non-verbal child to label basic nouns, action words, and adjectives.

The teacher designs a unique program for each child in her class, works with the child, and sets a performance level criterion or "aim," which indicates that a child is ready to progress to a subsequent step. Teachers use precision teaching to evaluate a child's progress as well as effectiveness of a program plan. Precision teaching is a classroom application of Precise Behavioral Management which is a system of measuring, describing, and predicting individual human frequency and celerations (5). A precision

teaching tool is a behavior chart which shows frequency of behavior over a period of time. Thus, even though a child's progress might be slow, his daily growth is demonstrated clearly on a chart.

An individual language program is inherently redundant in that each task is presented to the child numerous times until he can perform the task at a desired frequency (aim). When a child has performed at or near aim level for a length of time also determined by his teacher, he is advanced to a subsequent program step.

PURPOSE OF THE STUDY

The purpose of this study is to investigate implementation of the ENCOR Language Lattice. Three teachers' application of Language Lattice to Precision Teaching will be examined with emphasis on individual program design and student attainment of specified goals.

IMPORTANCE OF THE STUDY

> Inappropriate social responses and self stimulation (interpersonal and intrapersonal feedback) of retarded people are associated with limited communicative skills (2:139).

Language limitations serve not only to stigmatize a retarded person, but also hinder his learning. He is often unable to understand instructions or express needs. Therefore, teachers must accelerate appropriate communicative skills which will replace and thus decelerate inappropriate

communicative behavior. Then a child may begin to understand instructions as well as express needs. It takes a non-verbal child as many as thirteen steps to label nouns (say the name of an object when he sees it). A child's time may be wasted unnecessarily repeating a learned task.

This study may provide information leading to improvement of ENCOR Language Lattice implementation which will enhance student attainment of necessary language skills.

DEFINITION OF TERMS

The following definitions will enhance understanding of the study:

Lattice --A step by step diagram of behaviors needed to accomplish a complex behavior such as one word labeling vocabulary.

Project Step --A step which is indicated in the lattice. It is the goal behavior toward which procedures on a planning sheet are directed.

Planning Sheet--Description of procedures employed by a teacher to instruct a student. Included are: the Program (setting), Program Events (exactly how the project will be done), Acceleration Movement Cycle and Arranged Events, and Deceleration Movement Cycle and Arranged Events. Any of these areas can be revised to help the child acquire a desired skill or skills. Revisions are based on charted frequency.

Phase Change --Any alteration in any area of planning sheet based on charted frequency.

Movement Cycle--Isolated behavior to be increased or decreased in order to achieve a specified skill. The behavior itself may be the desired skill.

Arranged Event--A consequence of behavior which increases, maintains, or decreases the frequency of behavior.

Frequency (Rate) --The number of movements divided by the time in which the movements occurred.

LIMITATIONS OF THE STUDY

This study examines individual programs designed by three ENCOR teachers who have three to six year old students that have been placed in schools attended by normally functioning children. The study pertains only to the ENCOR Language Lattice and may not be applicable to any other language program.

Data to be analyzed come from an existing, uncontrolled body of information. Due to numerous variations in existing material, an experimental design was not attempted.

Chapter II

RELATED LITERATURE

Language programs which accommodate non-verbal, non-imitative children have been developed since 1970 (8). Several educators across the country are aware of the need for language programs which serve severely retarded non-verbal children. Therefore, they are developing language training programs for speech-deficient children among which are the severely mentally retarded.

Sailor, Guess, and Baer (8) have designed an experimental training model which is to be the framework for a training manual describing specific procedures and techniques. A manual is currently being tested within an applied behavior analysis framework and in the field. Data and information will be used to validate and revise training procedures and sequences. Final criteria for advancement are not specified in the article (8). A chart of the experimental speech and language program can be found in Figure one.

In McLean (6:155-190) Kent describes the language program that she developed. Included are detailed procedures, and criteria for advancement to the next step. Refer to Figures two and three. Criteria include: accepted

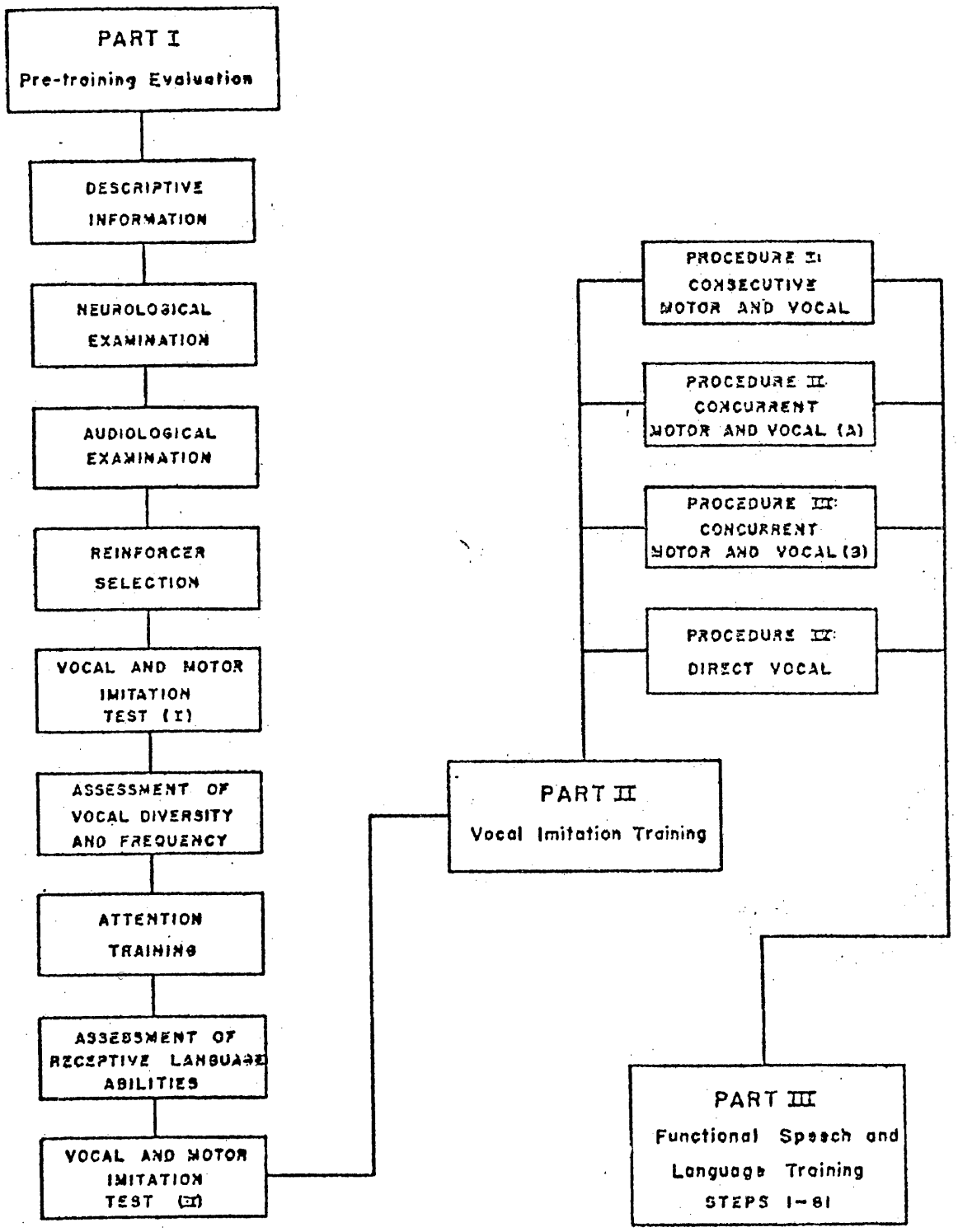

Figure 1. Flow Chart of Experimental Speech and Language Training Program (Reproduced from Sailor, Wayne, D. Guess, and D. M. Baer. "An Experimental Program for Teaching Functional Language to Verbally Deficient Children," Lawrence: University of Kansas, 1972.

Language Acquisition Program

Phases and parts: Prerequisites and options upon completion

Phase	Part	Prerequisite	Options upon completion
1.1.0.0 Attending	1.1.1.0 Sitting still	None	1.1.2.0 Elimination of incompatible behavior 1.1.3.0 Looking at objects
	1.1.2.0 Elimination of incompatible behavior	1.1.1.0	1.1.3.0 Looking at objects
	1.1.3.0 Looking at objects	1.1.1.0 1.1.2.0	1.1.4.0 Pretrial eye contact

Figure 2. "Phases and Parts" of Language Acquisition Program (From McLean, J. E., R. L. Schiefelbusch and D. E. Yoder, eds. Language Intervention with the Retarded, Baltimore, London: University Park Press, 1972).

Language Acquisition Program

Content chart

Part	Initial inventory	Training	Final criterion
1.1.1.0 Sitting still	Does child sit without prompts or receipt of reinforcers for 30 seconds?	Reinforce successive approxi-mations to 30 seconds.	Child sits without prompts or receipt of reinforcers for 30 seconds.
1.1.2.0 Elimination of incom-patible behavior	After final criterion is met in 1.1.1.0 does child exhibit incompatible motor behavior?	Reinforce successive approxi-mations to 30 seconds of sitting still.	Child remains seated and does not engage in incompatible behavior for 30 seconds without prompts or restraints.

Figure 3. "Content Chart" of Language Acquisition Program (From McLean, J. E., R. L. Schiefelbusch and D. E. Yoder, eds. Language Intervention with the Retarded, Baltimore, London: University Park Press, 1972).

percentage of error (10%), number of items presented, and number of trials per item. When a child learns a behavior, (i.e., part 1.1.1.0 of phase 1.1.0.0), the trainer administers an inventory. A child must have 90 percent correct in order to be advanced to the next "part" of the phase, (i.e., part 1.1.2.0 of phase 1.1.0.0). If preceding criteria are not met, training is resumed until another criterion is indicated (6:160).

In Schiefelbusch (9:84-94) Bricker describes a language training model that he has designed. The model appears in lattice form (basis of ENCOR Language Lattice). The lattice includes "Longitudinal Programs" which occur simultaneously with and are included in "Program Steps," and "Terminal States" or goals. Program steps are behaviors to be learned in order to accomplish specified terminal states or goals. Although program procedures are described, specific criteria for evaluation or advancement are not included. Bricker states that much validational data are being accumulated as the language program is being tested. However, an approach has not yet been systematized as to meet the most efficient procedures (9:90). Figure four includes a lattice of the language training model.

Speech and language can be trained with increasing efficiency by employment of behavior modification. "Precise measurement is the most important ingredient in utilizing this method (4)." The measurement technique described in

Johnson's article in Jorden (4) is Precision Teaching. Behavior frequency (number of times a behavior occurs over time during which behavior occurs) is a measurement recorded on a behavior chart. It is a useful datum for measuring human behavior because: (1) frequency has historical precedents, (2) two frequencies charted on a ratio scale show per cent, and (3) frequency appears to be a measure applicable to all human behavior (5). The ENCOR Language Lattice is applied to Precision Teaching whereas language programs previously mentioned are not (6, 8, 9).

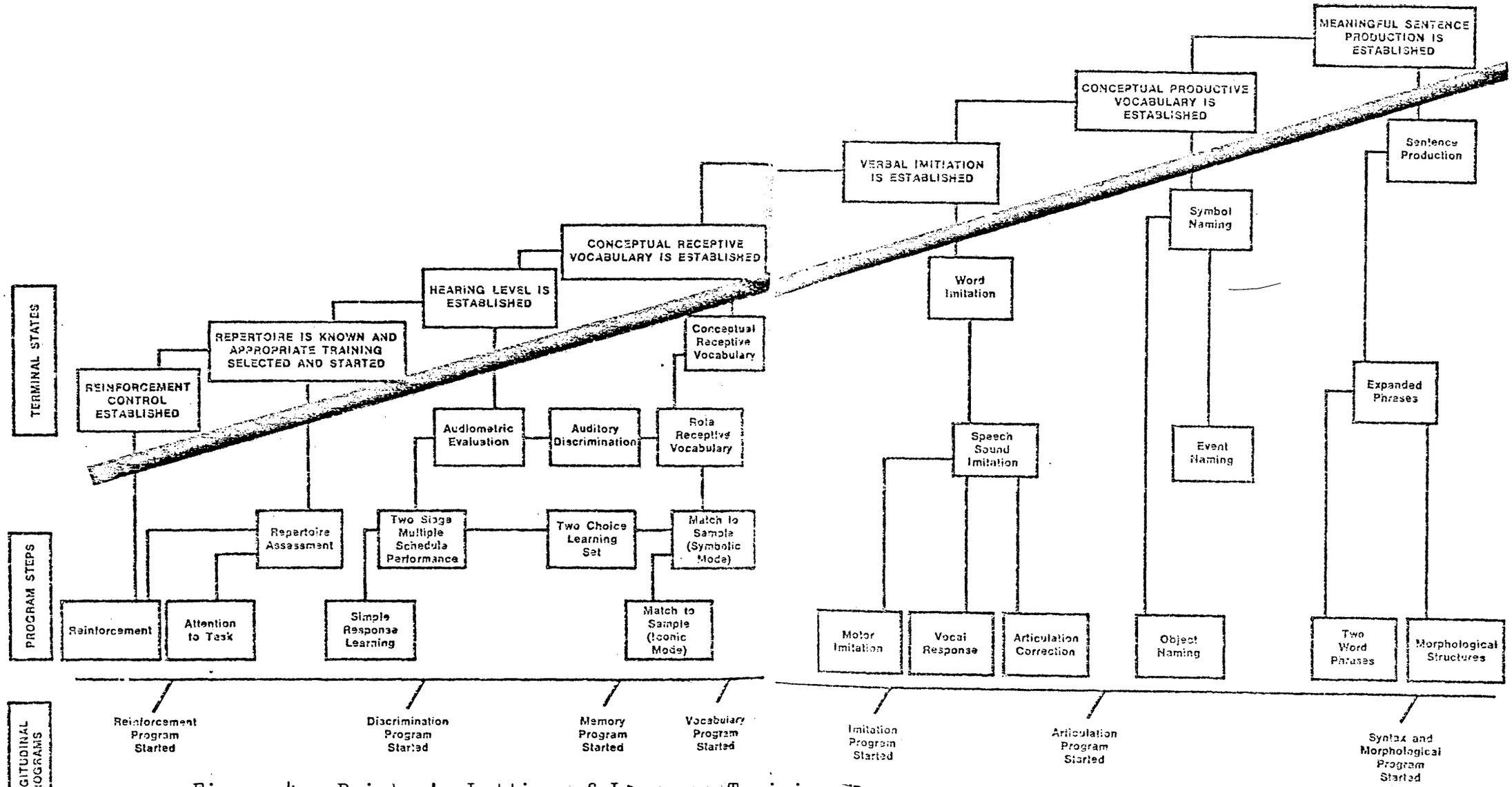

Figure 4. Bricker's Lattice of Language Training Model (Reproduced from Schiefelbusch, Richard, ed. Language of the Mentally Retarded. Baltimore, London: University Park Press, 1972.)

Chapter III

BACKGROUND AND RESEARCH DESIGN

This study is designed to provide an analytical description of the application of the ENCOR Language Lattice to Precision Teaching by three ENCOR teachers. Chapter III is divided into two basic parts. First, four sections providing background information on the nature of the ENCOR Language Lattice and its implementation through Precision Teaching technique will be presented. The second part of the chapter details the methods and procedures used to obtain the raw data for this study.

BACKGROUND

Theoretical Aspects of the Language Lattice

The Language Lattice was designed to teach a basic semantic aspect of expressive language--labeling (refer to Figures 5 and 6). McNeil (7:116-117) has discussed two theories of semantic development, i.e., horizontal and vertical development. He has referred to the process of a word being entered one time in a child's mind with new meanings continually being acquired as "horizontal development." Vertical development is described as the process of new, separate entries of the word being stored in

the mind every time a new meaning for the word is acquired. An example of horizontal development would be to learn that the single word "rake" can mean (1) a tool to gather leaves, or (2) gathering or heaping up, etc. Vertical development would consist of entering the word "rake" as meaning a tool to gather leaves on one occasion, and then entering a second word "rake" meaning gathering or heaping up. The ENCOR Language Lattice design encompasses a vertical semantic development.

Phonemics were included in the lattice in the area of imitation of sounds and sound chains. Teachers were encouraged to present sounds for imitation in the order of the sound acquisition of a normally functioning child. The teachers were instructed to observe the child, because frequently labeled sounds often were the sounds that the child would imitate most readily. The teacher and speech clinician working together devised projects suitable for each student. Eventually, a student learned to produce isolated phonemes and combine the phonemes to produce a word or an approximation of the word (i.e., /bo/ for "boat").

Morphology was taught in relation to action verbs presented in the form of present participles or third person present tense. The student was taught a specific form of the verb. Other forms of the verb could be taught in projects based on skills beyond the scope of the lattice.

The lattice was designed to teach a single basic linguistic skill, verbal labeling in one word phrases.

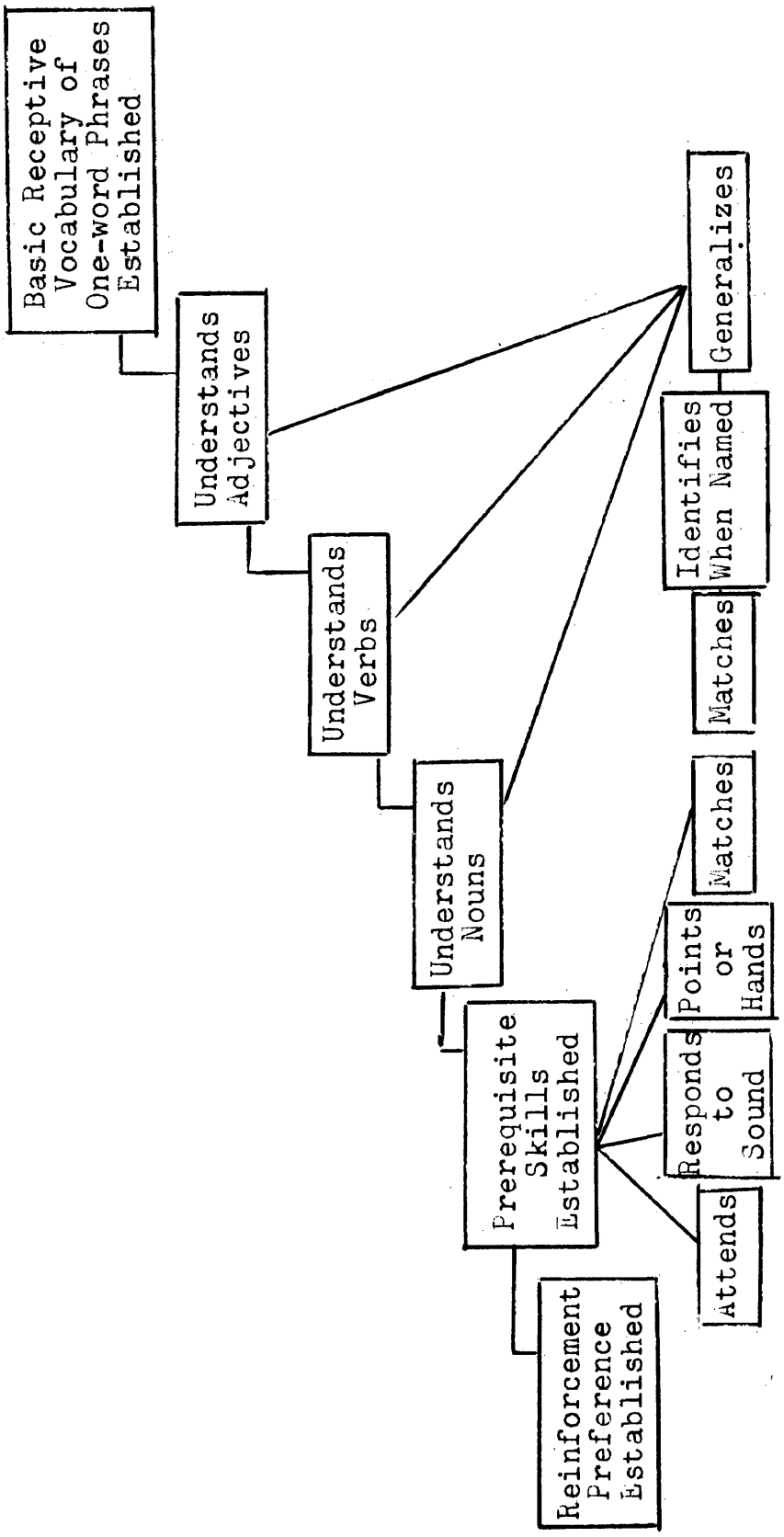

Figure 5. Receptive Lattice of the Eastern Nebraska Community Office of Retardation (ENCOR) Language Lattice.

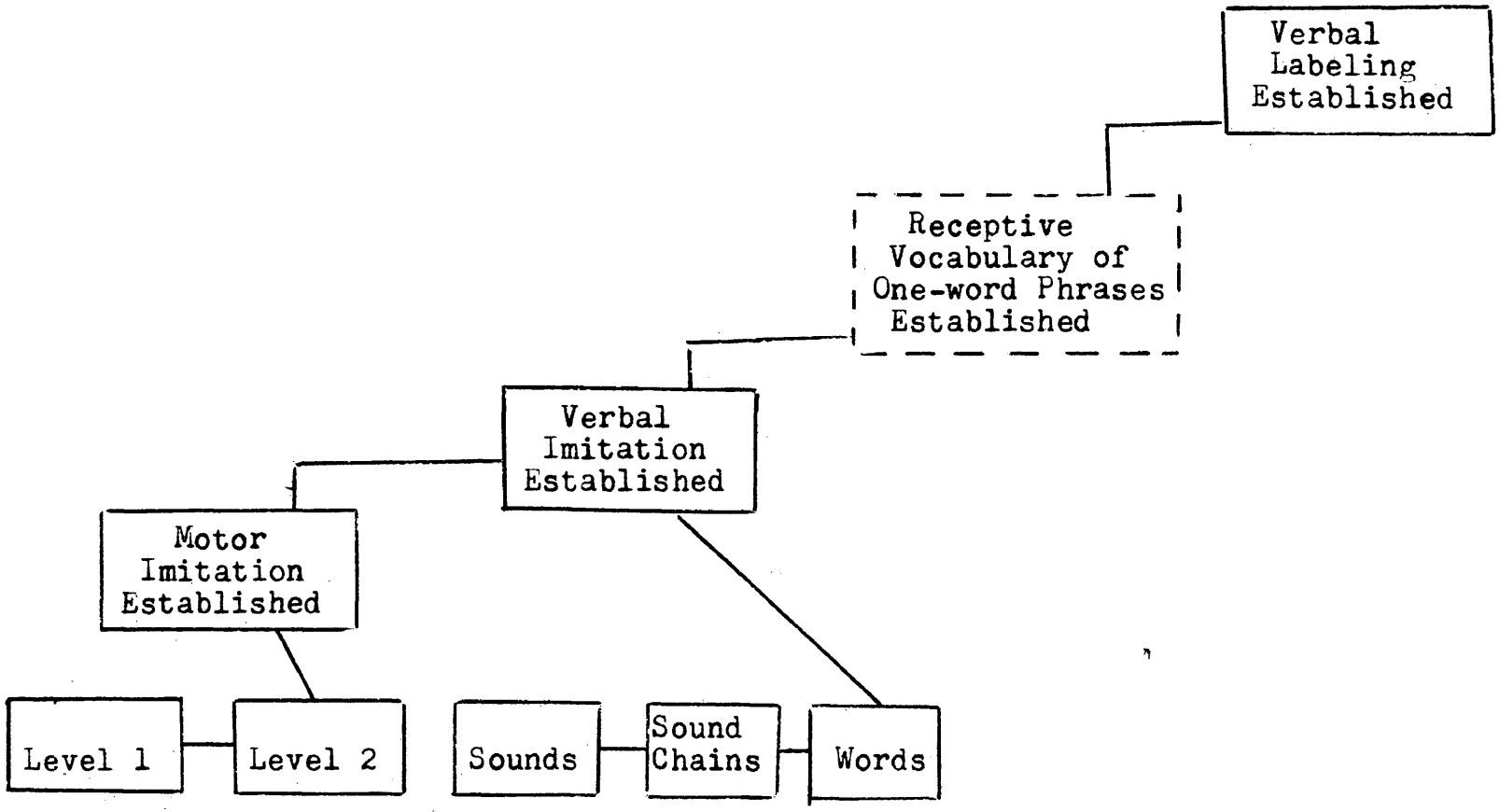

Figure 6. Expressive Lattice of the Eastern Nebraska Community Office of Retardation (ENCOR) Language Lattice.

A single concept for each word was presented in a concrete context. Thus, upon completing a labeling project, a student had acquired an essential skill which could serve as a stepping stone to further language development.

ENCOR teachers attended weekly inservice seminars headed by ENCOR speech clinicians who provided them with instruction. Teachers attended the seminars prior to implementing their individual language projects. Basic speech and language skills can be taught to persons possessing no measurable language skills. The receptive (understanding) and expressive (speaking) lattice (refer to Figures 5 and 6) combined constitute a guide for teachers to accomplish the goal of the lattice, i.e., teaching a student verbal labeling. Descriptions of the receptive lattice and of the expressive lattice, essentially as provided the participating ENCOR teachers during the inservice seminars, follow.

Description of the Receptive Lattice

The receptive lattice progresses step by step from "reinforcement control" to "receptive vocabulary of one-word phrases." Steps may be omitted providing students possess represented skills. The major areas or goals include: (1) reinforcement control, (2) prerequisite skills, (3) understanding nouns, (4) understanding verbs, and (5) understanding adjectives. Having mastered the preceding skills, the student will have obtained a receptive vocabulary of one-word phrases.

Reinforcement is defined as "presenting or terminating any stimulus event which will strengthen a class of responses (11:13)." A reinforcer is employed to increase the frequency of a behavior. It is important to determine what "stimulus event" actually increases the frequency of desired behavior. A stimulus event may work at one time and not another. Therefore, a teacher must be alert to a student's situation. Reinforcement control is established when a stimulus event affects behavior.

Prerequisite skills are those skills necessary to language stimulation and communicate comprehension of the stimulus presented. These prerequisite skills include: attending, response to sound, pointing or handing, and matching black and white.

Attending involves the observation of material or individuals presenting material, and may best be measured through the response of a student to a particular task.

Response to sound is simply defined as the ability to hear. This capacity may be tested by standing behind a student and presenting a sound. The student's reaction to this sound is then observed. A teacher may recommend additional testing of the student's hearing.

Pointing involves touching an object or a picture. This behavior may be trained through modeling or prompting. The teacher does not give the name of the object but merely says "point to" or "touch."

Matching is grouping of like objects according to color. Use of black and white compensates for color perception problems. This is the first step toward becoming aware of likenesses and differences between objects or pictures.

Receptive Tasks. Steps directed to the understanding of nouns, verbs, and adjectives include the same three skills:

1. Visual Discrimination: the ability to recognize differences and similarities between objects or pictures by attending to relevant properties.

2. Identification: matching the word (symbol) to the object or picture utilizing both auditory and visual senses.

3. Generalization: when the client who has been conditioned to respond to one stimulus, responds to novel stimuli within that class without specific training (11:43).

The teacher may include each step on the lattice or she may omit steps covering skills a student has already acquired. A maximum receptive project would include the following: establish reinforcement control, teach prerequisite skills, and teach three skills necessary to receptively understand nouns, verbs, and adjectives. To "Understand Nouns" a student first matches identical pictures of objects (visual discrimination), points to an object when it is named (identification), and then points to a variety

of pictures of an object previously "identified" (generalization). Generalization has occurred when a student identifies the pictures not previously conditioned.

The same three process steps are initiated to teach "Understanding Verbs." Visual discrimination involves matching identical pictures depicting an action. Pictures should emphasize action to prevent a student from attending to other visual cues (i.e., matching according to objects or colors). Identification consists of pointing to action words named. Generalization occurs when a student correctly identifies novelty stimuli (action pictures not previously conditioned). Another verb generalization skill involves a student performing an action presented verbally. Teachers may opt to have students perform an action as part of the teaching process.

"Understanding Adjectives" is designed to teach adjectives such as color or big and little. An example of visual discrimination in teaching "big" and "little" would consist of pieces of paper whose only difference (among pairs) would be size. Pointing to the object with the property stated--big or little--constitutes identification. When a student is able to point to novel stimuli having the property named, he has achieved generalization.

Description of the Expressive Lattice

The first skill illustrated on the expressive lattice is motor imitation. Two important factors are to be

considered before beginning an imitation project. First, a student must be under reinforcement control and must have the prerequisite skills established as outlined in the receptive lattice. Second, receptive and expressive projects must be presented simultaneously. A student must advance along both lattices in order to achieve verbal labeling skills. Refer to square in Expressive Lattice (Figure 6) marked receptive vocabulary of one-word phrases. The square denotes the combining of receptive skills with expressive skills prior to the establishment of verbal labeling. Receptive language has little use without some established means of expressing those skills; at the same time, expressive skills are meaningless if a student has little or no receptive material to stimulate expression. Teachers are encouraged to coordinate the items presented for a receptive project with items presented for an expressive project.

Motor imitation is a prerequisite skill for the development of other imitative skills. Two levels of motor imitation are presented. Level one involves the imitation of model movements which are used to manipulate objects. Object manipulation precedes the imitation of body movements because in many cases, object manipulation imitation is an easier task to teach than body part movements. Therefore, object manipulation occurs first in the lattice. Level two, body part movements, is the second step of motor imitation. The acquisition of these imitative skills leads to generalized motor imitation which may be used as the

transition from motor imitation to the imitation of sound. For example, the movements of arms and legs precedes finer movements of the mouth, lips, and tongue. See Appendix for a list of level one and two motor movements.

When generalized motor imitation has been established, the imitation of individual speech sounds is presented. Since individual sounds are the building blocks of words, a repertoire of sounds in isolation is to be established under imitative control. After individual sound imitation has been established, sound chains are then mastered. These sound chains may be consonant vowel combinations. They are selected as a transitional step between individual sound imitation and the imitation of words. Single words consisting of sounds previously learned (mainly one syllable) are presented for word imitation projects. Teachers are instructed to consult with a speech clinician regarding the sounds to be presented for imitation. The final step, verbal labeling, is achieved when a model for word imitation is no longer necessary. For a verbal labeling project a teacher presents a picture or object to a student; the student names the picture.

The suggested procedures for developing individual language projects were presented to ENCOR teachers following a discussion of the lattices. Initially, a teacher determines the present functioning level of each student. A check list of all skills in the lattice is included to provide a way to assess students. Refer to Appendix for

the check list. Some students may know action words but not know the names of objects. Therefore, an entire list should be given to prevent underestimating students' abilities. Lattice placement will be the first step on the check list in which a student is deficient. Both receptive and expressive inventories are to be taken. Evaluative problems occur when reinforcement control has not been established prior to assessment. A student may be able to identify objects and action words. However, maladaptive behavior interfers with accurate evaluation of the abilities. Check lists should be readministered once reinforcement control and possibly attending behavior have been established. Teacher observation of students in classrooms and student response to objects and to verbal instructions may indicate a higher level of functioning than the initial assessment indicates. In this case reevaluation may also be necessary.

The teachers choose the words to be taught from a list of basic words derived from a survey of teachers in all developmental centers and from speech clinicians. The words are mainly one syllable in length and consist of familiar objects, actions, and adjectives such as color and big--little. Particular words (i.e., bathroom, cookie) facilitate the expression of needs or wants. Refer to Appendix for a list of recommended words.

The recommendations for movements and sounds to be presented for imitation are provided to teachers.

Dr. William Bricker was consulted regarding the items to be included on the list. Refer to Appendix for the lists.

Description of Precision Teaching

The Language Lattice is to be applied to Precision Teaching, a method of organizing and evaluating a specific plan of instruction. A student's progress is measured on a daily basis. The evaluation process enables a teacher to assess her "plan" and make necessary adjustments. A basic tool of Precision Teaching is the Program Planning Sheet employed to describe a specific procedure of individual instruction. The writer has adopted the description of sections of the planning sheet from Water's (12) which includes the following items:

A. Program--overall setting.
   1. Clock time--The time of day the task is to be worked on.
   2. Setting--Physical location (e.g., classroom, resource room).
   3. Teacher-Student Ratio--The number of teachers to the number of students.
   4. Teaching time--The number of minutes of instruction related to the movement cycle prior to counting of behavior.
   5. Time sample--The number of minutes chosen to observe and count specified behavior.

B. Program Events--The events occurring during a timing which are extraneous to movements being counted on specific performance.
   1. Materials--The description of items employed during instruction.
   2. Instruction--The description of vocal or written prompts.
   3. After-work Reward--Something given to the child after timing for effort--not related to performance.
   4. Assistance--The description of guidance or cues given to help a student elicit desired behavior.

C. Movement Cycle--The behavior being observed, counted, and recorded.
   1. Acceleration Movement Cycle--The behavior to be increased in frequency.
   2. Deceleration Movement Cycle--The behavior to be decreased in frequency.

D. Arranged Event--The event with a potential for accelerating or decelerating behavior which a teacher plans to follow the occurrance of a movement cycle.

E. Arrangement--The rule of a relationship of acceleration movements to an acceleration arranged event or the relationship of deceleration movements to a deceleration arranged event.

A Precision Teaching Project consists of a target behavior to be accelerated or decelerated, a written plan, the presentation of a task to a student, and the evaluation of a student's progress through charting the frequency of behavior. An example of a project is to teach the imitation of sounds. Projects often contain numerous phase changes. A phase change is any adjustment in an area described on the Program Planning Sheet. A horizontal line is drawn prior to recording a change in the relevant section on the Planning Sheet.

An example of a phase change is an adjustment of the arrangement. Continuous reinforcement (each correct response is followed by an arranged event) is most effective for the acquisition of a skill (11:123). Once a skill has been acquired, a partial reinforcement schedule (not every correct response is reinforced) should replace a continuous schedule in order to promote retention (11:123). A change in the arranged event constitutes another type of phase change. A primary reinforcer (incentives such as food or water which interact directly with motivational state) may be replaced by a secondary reinforcer (stimuli which have acquired reinforcing properties). A primary reinforcer may be paired with a neutral stimulus (verbal praise). Eventually primary reinforcers may be omitted whereby a neutral stimulus becomes a secondary reinforcer.

As previously mentioned, student improvement is determined by daily measurement. Datum consists of the

frequency of behavior (movement over time) which is recorded on a chart. The chart has successive calendar days on the horizontal slope and movements per minute on the vertical slope. A "dot" represents accelerated movements and an "X" represents decelerated movements. The teacher determines the necessity of instituting a phase change by observing the frequency change over many days or weeks. For example, if the frequency of a desired behavior is not accelerating the teacher may make a change (i.e., another arranged event or easier movement cycle related to goal behavior). An increasing frequency of a behavior will reach an aim (goal frequency) determined by the teacher. A new movement cycle is then introduced. One way to determine an aim is to count the number of movements a normal person may execute in a specified time. Another method is to assess the average ability of a student in previous projects (preferably related tasks).

RESEARCH DESIGN

Methods and Procedures

Analytical descriptions of the implementation of the ENCOR Language Lattice to Precision Teaching by three ENCOR teachers were based on data from several sources. A description of the research methods and procedures used in obtaining these data follows.

Information regarding the potential of nine students included in the study was derived from ENCOR

psychological reports. These data included (1) chronological age, and (2) mental age. Each student and teacher was designated by number or letter.

Teachers were interviewed regarding their educational and professional background using the following six questions:

1. What college degree do you have?

2. What were your major and minor areas of study?

3. Did you teach prior to working at ENCOR? If yes, type of school, age of students, and subject taught.

4. What do you believe are the advantages of the Language Lattice; the disadvantages?

5. What courses in language development or language defects have you had?

6. Upon what criterion was your decision to make a project or phase change based?

Comments:

Three individual verbal labeling projects designed by each teacher in the study were analyzed in terms of program plan and student attainment of specified goals. Descriptive data were obtained from planning sheets employed to describe language projects in detail and from behavior charts used for recording frequency of designated behavior. Individual language project data included, (1) verbal labeling skills attained, (2) number of weeks prior to project change, (3) number of weeks prior to each phase

change, (4) number of words child labeled at time of project completion, and (5) steps mastered beyond those included in the language lattice.

Data were analyzed using descriptive statistics including frequency counts, ratios, arithmetic means, and minimum and maximum range values. Data to be analyzed comes from an existing and experimentally controlled body of information. Therefore, the nature of the research limited the design to descriptive statistics, and precluded the application of any comparative tests of observed differences.

Chapter IV

PRESENTATION OF THE DATA

The purpose of the study was to discuss the application of the Language Lattice to Precision Teaching by three teachers of the Eastern Nebraska Community Office of Retardation (ENCOR). Data were described from (1) the Precision Teaching planning sheets and behavior charts, (2) ENCOR psychological reports, and (3) personal interviews of the three ENCOR teachers.

Presentation of Raw Data

Verbal labeling was chosen as the main area to be discussed. Verbal labeling is the end product of the Language Lattice towards which preceding steps (i.e., imitation, receptive identification) are directed. Although all nine retarded students participated in receptive identification and imitation projects, information pertaining only to verbal labeling projects will be included in the tables. The information gathered from each student's language projects appearing in Tables I-III includes, (1) the names of verbal labeling projects and phase changes (steps), (2) the time in weeks spent on each step, (3) the number of words presented for each step, (4) the frequency of movements performed per minute at the time of step

termination, and (5) the opportunities to elicit a correct response that were given to the student. No two verbal labeling projects listed in Tables I, II, and III occurred simultaneously. Goals in the receptive lattice include "Understanding Nouns" and "Understanding Verbs." The term "objects" which is more concrete than the term "nouns" is used in the tables and the related discussions in place of nouns. The term "action words" replaces the term "verbs." The writer believes that object and action words are more appropriate terms than nouns and verbs in that they more accurately describe the type of words acquired by the students.

Table I represents the performance of three students instructed by teacher A. All three students were able to verbally label object words and action words. Both students A2 and A3 attained skills beyond the lattice; namely, answering in the form of subject-verb-object and answering in the form of subject-verb, respectively. The two and three word phrases were formed by combining previously learned object and action words. The chronological ages were 5 years, 3 months for students A1 and A3, and 5 years, 6 months for student A2. Students A1 and A3 both demonstrated mental ages of 3 years, 1 month and student A2 attained a mental age of 3 years, 5 months. Refer to Table I for specific performance data.

Represented in Table II are the achievements of three students instructed by teacher B. Students B1 and B2

TABLE I

PERFORMANCE ON VERBAL LABELING PROJECTS BY THREE STUDENTS INSTRUCTED BY TEACHER A

Student	Project	Phase Change	Words	Weeks	Frequency	Opportunities
A1	Labels objects		5	3	15	16
		Add 5 words	10	3	16	16
		Add 3 words	13	7	17	18
		Add 4 words	17	12	18	19
		Add 10 words, drop 7	20	5	18	19
	Labels actions		5	8	5	6
A2	Labels objects		5	4	16	17
		Add 5 words	10	4	18	19
		Add 5 words, drop 5	10	4	15	16
	Labels actions		10	9	9	10
	Answers in subject-verb		10*	8	18**	20**
	Answers in subject-verb-object		10*	5	2**	24**

*The number of two-word phrases.

**Frequency and Opportunities are based on the number of words per phrase multiplied by the number of phrases per minute.

TABLE I (continued)

Student	Project	Phase Change	Words	Weeks	Frequency	Opportunities
A3	Labels objects		10	5	15	16
		Add 5 words	15	4	18	20
		Add 5 words, drop 5	15	11	18	20
		Add 10 words, drop 5	20	4	16	16
	Labels actions		10	7	8	10
	Answers in subject-verb		10*	3	16**	18**

*The number of two-word phrases.

**Frequency and Opportunities are based on the number of words per phrase multiplied by the number of phrases per minute.

TABLE II

PERFORMANCE ON VERBAL LABELING PROJECTS BY THREE STUDENTS INSTRUCTED BY TEACHER B

Student	Project	Phase Change	Words	Weeks	Frequency	Opportunities
B1	Labels objects*					
	Labels actions*					
B2	Labels objects		4	4	11	12
	Labels actions		4	3	9	10
		Add 4 words, drop 4	4	4	4	5
B3	Labels objects		10	7	2	2**
		Add 10 words, drop 10	10	7	2	2**
		Add 10 words, drop 10	10	4	7	7
		Add 7 words, drop 7	10	3	12	13

*Data not available.

**Low Opportunities are due to group participation.

TABLE III

PERFORMANCE ON VERBAL LABELING PROJECTS BY THREE STUDENTS INSTRUCTED BY TEACHER C

Student	Project	Phase Change	Words	Weeks	Frequency	Opportunities
C1	Label objects		5	5	6	6
		Add 3 words, drop 3	5	5	6	7
		Add 3 words, drop 3	4	4	3	4
C2	Label objects		3	4	4	4
		Add 2 words, drop 2	3	2.5	5	5
		Add 2 words, drop 2	3	2.5	4	4
C3	Label objects		3	3	3	4

attained verbal labeling of object and action words. However, charts and planning sheets depicting the performance of student B1 were not available for analysis. Student B3 achieved verbal labeling of objects. The chronological ages were 6 years, 8 months for B1, 5 years, 3 months for B2, and 4 years, 2 months for B3. The mental age attained by B1 was 2 years, 2 months while B2 earned a mental age of 2 years, 5 months; and B3 earned a mental age of 2 years, 3 months. Refer to Table II for the specific performance data of students B2 and B3.

Table III illustrates the achievements of three students instructed by teacher C. The three students attained verbal labeling of objects. The chronological ages of students were 4 years for C1, 3 years, 4 months for C2, and 2 years, 8 months for C3. Refer to Table III for specific performance data.

Data regarding the teachers' educational and professional background were drawn from personal interviews of each teacher. Teacher A holds a B.A. degree in Speech Therapy with a minor in Special Education, teacher B has a B.S. degree in Child Development, and teacher C has earned a B.A. degree in Child Psychology. A has had a course in normal language development, B has had a course in the normal acquisition of speech sounds, while C has had no course in language development or related areas. No teacher had teaching experience prior to working for Eastern Nebraska Community Office of Retardation (ENCOR).

Comprehensive planning sheets completed by three ENCOR teachers provided information concerning the materials used, the types of arranged events, and the schedules of reinforcement employed with each of the nine children studied. All three students employed Peabody Picture Cards containing representations of objects and action words to be labeled by the students. Teacher C used actual objects before she presented pictures to her students. The arranged event employed by teachers A and B was verbal praise. Teacher C combined verbal praise with an edible (i.e., icing, marshmallows). All three teachers employed a continuous fixed ratio schedule of one arranged event for every correct response.

Statistical Analysis

The aforementioned raw data illustrated in Tables I, II, and III were re-organized for comparative purposes. Descriptive statistics represented in Tables IV and V include arithmetic means, minimum and maximum range values, and ratios which were applied to the accumulated raw data found in Tables I, II, and III.

Table IV represents a statistical description of the performance of the nine students grouped according to their instructors on the verbal labeling of object words tasks. Each section of Table IV includes (1) the mental age, (2) I.Q., (3) the range and mean of both the frequencies (student rate of production) and the number of opportunities

TABLE IV

DESCRIPTIVE ANALYSIS OF INDIVIDUAL STUDENT PERFORMANCE ON VERBAL LABELING OF OBJECTS IN TERMS OF RANGES, MEANS ($\bar{x}$), COUNTS, AND RATIOS

Student	Mental Age	I.Q.	Frequency Range	Frequency ($\bar{x}$)	Opportunities Range	Opportunities ($\bar{x}$)	Words	Weeks	Words per Week
A1	3-5	54	15-18	17	16-19	18	27	30	.90
A2	3-1	57	15-18	16	16-19	17	15	16	.94
A3	3-1	59	15-18	17	16-20	18	30	24	1.25
(Group $\bar{x}$)	(3-3)	(57)		(17)		(18)	(26)	(23)	(1.03)
B1	2-2	33	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
B2	2-5	46	N.A.	11	N.A.	12	4	4	1.0
B3	2-3	54	2-12	6	2-13	6	27	21	1.3
(Group $\bar{x}$)	(2-3)	(43)		(9)		(9)	(16)	(13)	(1.25)
C1	2-3	56	3-5	5	4-7	6	11	14	.78
C2	2-0	61	4-5	4	4-5	4	7	9	.78
C3	2-0	75	N.A.	3	N.A.	4	3	3	1.00
(Group $\bar{x}$)	(2-1)	(64)		(4)		(5)	(7)	(9)	(.89)
(Total $\bar{x}$)	(2-7)	(58)		(9)		(11)	(16)	(12)	(1.06)

(teacher rate of presentation) for all the steps pertaining to verbal labeling of object words, (4) the total words consistently labeled, (5) the total number of weeks required to complete the project, and (6) the ratio of words acquired per week for each of three students taught by the same instructor. In addition, the table illustrates the group means of the students instructed by teachers A, B, and C for mental age, frequencies, number of opportunities, words, weeks, and the ratio of words per week.

The data in Section 1 of Table IV illustrate that all of the students instructed by teacher A achieved the same range of frequencies, and approximately the same individual mean frequency (a difference of one word per minute) for verbal labeling of objects. The range and average number of opportunities of each student were also approximately the same for all three students. Mental ages among the three students differed by no more than 4 months. Section 2 of Table IV illustrates that data for B1 was not available for analysis. In addition, a range of frequencies and opportunities appeared only for student B3. Therefore, discussions of frequency and opportunity illustrated in Section 2 will be limited to the mean of students B2 and B3. The two individual average frequencies of students B2 and B3 differed by five words per minute. The mean number of opportunities of B2 differed from those of B3 by six opportunities per minute. The low average number of opportunities and the average frequency of B3 compared to B2

was due to a group of students participating in two of the four verbal labeling steps. The average frequency of the two steps of individual instruction yielded a mean of 9 words per minute which varied from the mean frequency of B2 by 3 words per minute. The mental ages of B2 and B3 differed by 2 months. Section 3 of Table IV illustrates that the range of frequencies for C1 and C2 were approximately the same. The average frequency among C1, C2, and C3 differed by no more than 2 words per minute. The range of opportunities of C1 and C2 were approximately the same. The average mean number of opportunities differed by no more than 2 words per minute among students C1, C2, and C3. Mental ages differed by no more than 3 months among the three students. There was little difference within each group of students of teachers A, B, and C in the areas of frequency, opportunities, and mental ages as illustrated in the preceding presentation of the data.

The data presented in the three sections of Table IV indicate that the frequency rates of the nine students who attended Eastern Nebraska Community Office of Retardation developmental centers ranged from 2 to 18 object words labeled per minute. The mean frequency was 9 words labeled per minute. The number of opportunities presented per minute ranged from 2 to 20 words a minute. The mean number of opportunities presented were 11 per minute. Mental ages ranged from 2 years to 3 years, 5 months. The average

mental age of the nine mentally-retarded students was 2 years, 7 months.

The data in Table IV illustrate the following information pertaining to the total object words acquired, the total weeks required, and the ratio of words learned per week by each of the nine mentally-retarded students. The discussion will be limited to 8 students because data pertaining to B1 were unavailable for analysis. The range of total object words labeled among the 8 students surveyed was 3 to 30 words. The mean number of words acquired was 16. The number of weeks required to learn the total number of words ranged from 3 to 30 weeks among the 8 students analyzed. The average length of time to correctly label the total words was 12 weeks and the ratio of words learned per week ranged from .89 to 1.25 words per week. The average ratio among the 8 students was 1.06 object words learned per week. The total number of words paralleled the total number of weeks for each student. The maximum difference between the total number of words and the total number of weeks for any 1 student was 6. The smallest difference among the investigated factors of all the students was the difference between the minimum and maximum words learned per week of 1/2 word per week. Therefore, although B2 acquired a total of 4 words and B3 acquired a total of 27 words the average ratio of words acquired per week for B2 and B3 were about the same. The same comparison can be made between A2 and C3 where A2

acquired 12 more words than C3 at approximately the same rate of words per week. Student A2 who achieved a higher total of words than C3 at approximately the same rate of words per week had a higher mental age than C3. However, B3 who had acquired more total words than B2 at approximately the same rate of words per week as B2 had a lower mental age than B2. The rank order of the average number of words learned for each group of 3 students varied consistently with the rank order of the average mental age of the 3 students of each group. However, the rank order of the average ratio of words learned per week per group did not vary consistently with the rank order of the average mental age per group.

Five of the 9 students progressed from verbal labeling of object words tasks to verbal labeling of action words. Data of only 4 of the 5 students were available for analysis. The data in Table V which pertain to tasks of verbal labeling of actions will be compared to the data in Table IV which pertains to verbal labeling of object word tasks. The average frequency of action words labeled per minute by each of the 4 students was less than their individual average frequency for verbal labeling of objects. However, among each of the 4 students the average number of opportunities of action words per minute differed from the individual average frequency of action words per minute by no more than 1 or 2 words per minute. The total number of action words acquired by A1, A2, and A3 were reduced by 1/3 to approximately 4/5 of the total number of object words

TABLE V

DESCRIPTIVE ANALYSIS OF INDIVIDUAL STUDENT PERFORMANCE ON VERBAL LABELING OF ACTIONS IN TERMS OF MEANS ($\bar{x}$), COUNTS, AND RATIOS

Student	Mental Age	I.Q.	Frequency	Opportunities	Words	Weeks	Words per Week
A1	3-1	54	5	6	5	8	.625
A2	3-5	57	9	10	10	9	1.1
A3	3-1	59	8	10	10	7	1.4
(Group $\bar{x}$)	(3-2)	(57)	(7)	(9)	(8)	(8)	(1.04)
B1	2-2	33*	N.A.*				
B2	2-5	46	4	5	8	7	1.1
B3	2-3	54	N.A.**				
(Group $\bar{x}$)	(2-3)	(43)		(5)	(8)	(7)	(1.1)
C1	2-3	56	N.A.**				
C2	2-0	61	N.A.**				
C3	2-0	75	N.A.**				
(Group $\bar{x}$)	(2-1)	(64)					

*Data not available for analysis.

**Did not achieve verbal labeling of action words.

acquired by the students. However, student B2 acquired twice as many action words as object words. The greatest difference between the total number of words and the total number of weeks was 3. The rate of words acquired per week improved from object words to action words for A2, A3, and B2. Student A1 acquired action words at a decreased rate of words per week compared to the rate of object words per week.

Both students A2 and A3 advanced to steps beyond the lattice. A2 had a frequency of 16 object words per minute, 9 action words per minute, 9 subject-verb phrases per minute and 7 subject-verb-object phrases per minute. A3 attained a frequency of 17 object words per minute, 8 action words per minute, and 8 subject-verb phrases per minute. The frequency of 2 and 3 word phrases per minute can be converted to the frequency of words per minute by multiplying the number of words per phrase by the number of phrases per minute. Thus, A2 improved from a frequency of 16 object words per minute and 9 action words per minute to a frequency of 18 words per minute spoken in subject-verb combinations. Student A2 finally achieved a frequency of 21 words per minute spoken in subject-verb-object combinations. A3 proceeded from a frequency of 17 object words per minute to a frequency of 8 action words per minute to a frequency of 16 words per minute spoken in subject-verb combinations. Object words and action words previously learned by A2 and A3 were combined to form the subject-verb and subject-verb-object phrases achieved by the 2 students.

Therefore, a ratio of words acquired per week could not be compared to ratios in previous projects where all the words were newly acquired. The ratio of phrases acquired per week cannot be compared to words acquired per week because single words and phrases are not equal.

Chapter V

SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

This study was devised in an effort to provide an analytical description of the implementation of the Eastern Nebraska Community Office of Retardation (ENCOR) Language Lattice to Precision Teaching by three ENCOR teachers. Essential data were derived from the following sources: (1) psychological reports, (2) planning sheets, (3) behavior charts, and (4) personal interviews of teachers.

The nine ENCOR students included in the study ranged in age from two years, eight months to six years, eight months. All the students were ambulatory and, following the period of Precision Teaching described by the study, placed in schools or settings outside of the Eastern Nebraska Community Office of Retardation developmental centers. Each of the three teachers included in the study instructed three of the nine students. No student had more than one of the teachers.

Data regarding students consisted of (1) the chronological age of each student, (2) the mental age of each student, (3) I.Q., (4) the types of verbal labeling

projects and phase changes, (5) the frequency of behavior for each project and phase change, (6) the words acquired for each project and phase change, (7) the number of weeks spent on each project and (8) the number of words acquired per week. Data regarding teachers consisted of (1) educational background, (2) professional background, (3) opinions concerning the lattice, (4) criteria for advancing a student, and (5) opportunities to respond provided a student.

Data were analyzed using descriptive statistics including frequency counts, ratios, arithmetic means, and minimum and maximum range values. Statistical information was organized into three distinct groups: (1) each child individually, (2) the three students of each teacher, and (3) all nine students.

DISCUSSION

Data were collected to describe the teacher's application of the Language Lattice to Precision Teaching in terms of the effectiveness of the lattice as a guide for teaching mentally retarded students verbal labeling skills and the efficiency of the teachers in designing and implementing language projects. The success of the teachers in employing the lattice and the efficiency of their applying the lattice to Precision Teaching is the basis of the following discussion.

The Language Lattice outlined steps for instructing mentally retarded children to verbally label one word

phrases consisting of nouns (objects), verbs (actions), and adjectives. The final goal, "Verbal Labeling of One Word Phrases Established" denotes the ability to verbally label words in all three areas. The teachers were successful to a degree in teaching their students to verbally label. The three students of teacher A were able to verbally label objects words and action words. Adjectives were not labeled by any of teacher A's students. Two of the students, A2 and A3, went beyond the level of the lattice to attain subject-verb phrases and student A2 was able to produce three word phrases in the form of subject-verb-object. The three students of teacher B achieved verbal labeling of objects. B1 and B2 attained verbal labeling of action words. No student in group B labeled adjectives or advanced beyond the level of the lattice. The students of teacher C each labeled only object words. The students of group A who achieved the most verbal labeling skills had the highest average mental age. Students of group B ranked between group A and C in the number of verbal labeling skills and the average mental age, while group C students ranked third in the number of verbal labeling skills and third in the average mental age.

It is the impression of this writer that the teachers' educational background contributed to the relative success of their projects. Teacher A's degree in Speech Therapy which included a course in normal language development was more closely related to the subject of the

lattice than the degree of teacher B which was in Child Development or the degree of teacher C which was in Child Psychology. Therefore, teacher A was better equipped to bring the lattice to its logical conclusion as the performance of her students indicated that she did. Teacher B had a course in normal speech development which this writer believes contributed to her success in advancing two students to verbal labeling of action words. The disadvantages of the lattice expressed by each teacher in a personal interview were a good indication of their grasp of the material presented in the lattice. Teacher A expressed concern about what the lattice omitted (i.e., steps beyond labeling of single words and methods for carry-over) which indicated to this writer that she understood the skills set forth in the lattice. Teacher B expressed only that she did not understand how to design a project for the step "Understanding Adjectives." She appeared to understand the areas of "nouns" and "verbs" as two of the three students surveyed progressed to verbal labeling of verbs (actions). Teacher C reported that she needed more general information. The introductory information presented in the seminars must have not been entirely clear or complete for teachers B and C. Therefore, the initial presentation of the lattice during the introductory seminars apparently affected the teachers' success in implementing the lattice.

In addition to investigating the success of teachers in instructing their students to verbally label, this writer

examined the efficiency of teachers in implementing the lattice and applying it to Precision Teaching. A primary question to be answered regarding efficiency is: Were the students given the opportunity to learn as much as they were capable of achieving in a minimum time span? The discussion which follows attempts to answer this question through (1) an analysis of the patterns of project implementation and (2) comparisons of the performance profile of the students involved as revealed by the data presented in Chapter IV.

The patterns of project implementation by the three ENCOR teachers can be described in terms of the opportunities provided for a student to respond, the number of words presented to be acquired by the student, the schedule of reinforcement and arranged event employed by the teacher, and the criteria for a project or a phase change. The schedule of reinforcement employed by all three teachers was a continuous fixed ratio of one arranged event for each correct response (1/1). All three teachers employed verbal praise as an arranged event; however, teacher C used an edible in conjunction with verbal praise. The addition of food might have been necessary to motivate children as chronologically young and as mentally young as teacher C's students. However, the average frequency of words per minute for group C was lower than the average frequency for group A and B. Therefore, the addition of an edible did not increase the frequency of production of the students of group C as

compared to groups A and B. All three teachers based their criteria for project or phase change on a child's having achieved or approximated a predetermined goal frequency set by his teacher. The similarities between the schedule of reinforcement, arranged event, and criteria for change would eliminate them as factors which improve the efficiency of one teacher compared to the efficiency of another.

The number of opportunities per minute provided by the teacher is an aspect of the pattern of teacher implementation. Since all recorded frequencies differed from all recorded opportunities by no more than two movements per minute, this writer assumes that the number of opportunities presented by the teacher affected the frequency of student production. Teacher A provided her students with an efficiently high number of opportunities per minute and thus, they produced a relatively high frequency of words per minute. Those students in group B and C who were given fewer opportunities produced at a lower rate than the students of group C. This writer believes that since the data consistently demonstrates that students produced at approximately the same rate of words per minute as the rate of opportunities presented per minute, students of group C, and possibly group B could have produced at a higher rate if they were given the chance. In other words, the teacher sets the pace at which the students will produce. A perfect example is B3 who increased her rate of producing words from two to twelve words a minute when the number of opportunities

per minute changed from two to thirteen. Another example of a teacher setting the pace at which a student will produce is reflected by the projects of A2 and A3. The frequency of words per minute which A2 and A3 attained as they progressed from tasks of labeling objects and labeling actions to tasks of answering in two and three word phrases is illustrated in Figure 7. The figure clearly demonstrates that even though a student was answering in two and three word phrases, a more complex task than labeling single action words, the difficulty of her performing a task was not the determining factor in her frequency of production. A2 and A3 produced words at a higher frequency per minute for the more complex task of answering in two and three word phrases. Since for each progressive task the average frequency matched the average number of opportunities this writer assumes that the teacher's rate of presenting the pictures (opportunities) controlled the students' rate of producing the words (frequency).

Generalization refers to the ability of a person to consistently apply what he has learned in one situation to other situations which have similar attributes. Therefore, once a student has achieved verbal labeling of object words at a particular frequency of words per minute, she should be able to achieve verbal labeling of action words at approximately the same frequency (by the time of step termination) and ratio or better, in that the learning process for both tasks is very similar. There is positive

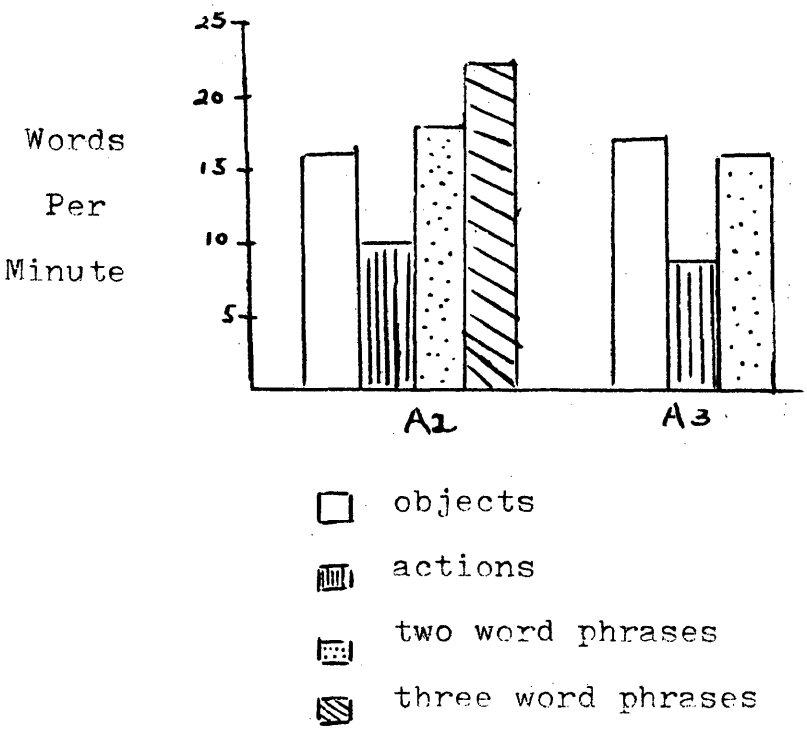

Figure 7. The Average Frequency of Words Per Minute produced by A2 and A3 in Successive Tasks

evidence to assume that students did not maintain the same frequency when they proceeded from object words to action words because they were given a decreased rate of opportunities per minute. Although the average frequency of words per minute for A2 and A3 decreased from the task of labeling objects to the task of labeling actions, the number of opportunities as well as the frequency increased from the task of labeling action words to the task of answering in two or three word phrases. Generalization can also be explored in terms of the rate of words acquired per week. A student should be able to acquire more new words in less time as he progresses from tasks of labeling object to labeling actions, etc. because the learning process for both tasks is very similar. Of those students who progressed beyond the task of labeling objects only A1 attained a lower ratio of words learned per week for action words than the ratio she attained for object words. Students A2, A3 and B2 improved in the ratio of words acquired per week from the task of labeling objects to the task of labeling actions. However, in each case the improvement was less than one word per week. Therefore, in terms of words acquired per week the data indicated that generalization did not occur from the task of labeling objects to the task of labeling actions. It is not within the scope of this study to determine the cause of the inability of students to generalize from one task to the succeeding related task regarding the rate of words acquired per week.

Therefore, the writer will attempt to isolate the factor or factors which enable one to evaluate a student's rate of words acquired per week. There was a wide range of total words acquired among the eight students surveyed. However, the rate of words per week differed by no more than one-half word per week among all eight students. Obviously some students spent much more time on labeling tasks than others. It is beyond the limits of this study to explore the time spent previous to learning to label objects or the progress made by students when they were placed outside of the Eastern Nebraska Community Office of Retardation developmental centers. Therefore, the discussion will attempt to explore the frequency of words produced per minute as it relates to the rate of word acquisition.

One definition of efficiency is "to produce the desired product with a minimum of waste (13)." Referring to the task of labeling objects, all students acquired words at approximately the same rate of words per week; however, the students differed in the average frequency at which they produced the words. It would be "wasteful" for a student to spend any length of time acquiring words while during that entire time she was producing them at a lower frequency of words per minute than she was capable of achieving. Although a student C3 had a <u>finished</u> product in three weeks of being able to label three words, she could say the words at a frequency of only one word per 33 seconds. Therefore, she did not have a relatively <u>worthwhile</u> product.

A normal child's rate of producing sentences (a minimum of three words per sentence) has been found to be one word per second or sixty words per minute. Comprehension for the same child was found to be best at one word per second (7:102). Although a retarded child does not produce words at as high a frequency as a normal child does, he should be able to speak at a rate which approximates that of a normal speaking child at the same mental age and at a rate which would enable a peer to easily understand him. However, teacher C maintained C3 at a frequency of one word per 33 seconds when she should have been approaching one word per second. Thus, the child's time was wasted even though she learned to say one new word every week for three weeks.

Another student, B2, maintained her rate of word acquisition when she progressed from labeling objects to labeling actions. However, her frequency of words produced per minute decreased from eleven words per minute to four words per minute. Teacher B had reduced her opportunities per minute from twelve to five words a minute. B2 was prevented from generalizing because the number of opportunities presented per minute were reduced. Therefore, she was unable to improve her frequency of words per minute as she advanced from labeling objects to labeling actions.

Teacher A became more efficient as students A2 and A3 progressed beyond the lattice. Although she reduced the number of opportunities from the task of labeling objects to the task of labeling actions, she doubled the number of

opportunities when the students advanced to the task of answering in two and three word phrases. Thus, A2 and A3 were approximating a normal frequency by speaking words at a rate of one word per 3.6 to three seconds, two to three seconds lower than the rate of a normal child. The writer must ask the question: Could students B2 and C3 have continued acquiring words at the same rate of words per week if in fact the number of opportunities had been increased instead of maintained or decreased? Even if the answer is no, which did not seem to be indicated by the data, one must consider the priorities of an efficient project design which will enable a student to acquire a worthwhile product. If the child's frequency of words spoken per minute cannot be comprehended, it does not matter that the child is learning to say a new word every week.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

All of the nine students included in the study achieved verbal labeling of object words. Five students attained verbal labeling of action words (data were not accessible for B1) and two students advanced beyond the level of the lattice. Therefore, the Eastern Nebraska Community Office of Retardation (ENCOR) Language Lattice was an effective guide as demonstrated by the success of the teachers in instructing their mentally retarded students to consistently label object and action

words. The weakness of the lattice occurred in the area of adjectives as demonstrated by the total absence of labeling adjectives projects. Teacher B however, designed and implemented a receptive project for identifying adjectives for student B1.

The process that the teachers employed for implementing the Language Lattice and applying it to Precision Teaching was investigated in terms of efficiency. The discussion of the question of whether or not the students were provided with the chance to acquire and produce as much as they were capable of achieving in a minimum time span was divided into two areas:

1. An analysis of the patterns of project implementation.

2. Comparisons of the performance profiles of the students involved in the study.

First, analysis of the patterns of project implementation revealed that similarities among the schedules of reinforcement, arranged event, and criteria for step change employed by each teacher eliminated them as factors which improved the efficiency of one teacher compared to another. Another finding was that the rank order of the average number of opportunities presented to the students by teachers A, B, and C corresponded with the rank order of the average mental ages of the students in groups A, B, and C. The rank order (by group) of the average number of opportunities did not correspond with the

average I.Q. of the students. The discrepency between the I.Q. and mental age as they each relate to the number of opportunities presented cannot be explained within the scope of this study. However, the data revealed that the teachers determined the maximum frequency of words per minute at which students were able to produce single words and combinations of words by the number of opportunities that they provided the students. Therefore, a major factor in a teacher's efficiently implementing the Language Lattice and Precision Teaching was to provide a student with a relatively high rate of words presented per minute when the student began labeling objects. The student would then be starting with a frequency that approximated the normal frequency of producing words which could be maintained or increased.

The frequency of words per minute increased from one task to the next when the number of opportunities increased from one task to the next. However, the rate of words learned per week by each student increased by a maximum of less than one word per week from one task to the succeeding task. Why did students improve in frequency and not in the rate of word acquisition? The data did not provide a clear answer to this question. The number of opportunities presented per minute influenced the frequency of words spoken per minute. The preceding question could, therefore, be answered if one could isolate the factor or factors which influenced the rate of words learned per week.

However, the minimal difference among the ratios of the number of words learned per week made it difficult to isolate the factors which caused the difference.

An attempt to isolate the factors which affected the rate of word acquisition yielded the following findings. The total number of words that a teacher should have presented for each task was not specified by the authors of the lattice. Therefore, each teacher decided the number of words to present and chose the words from the suggested "Basic Vocabulary Word List." Refer to the Appendix. The total number of words acquired by each student varied consistently with the average mental age of each student; the higher the mental age the more words he learned. The total number of weeks varied consistently with the total number of words for each student. Thus, the ratios of words acquired per week by each student were slightly above or slightly below one.

Although it is not within the sphere of this study to determine the specific interaction of factors which would improve the rate of words learned per week, the data did indicate that the rate of words learned per week could be evaluated in terms of the average frequency of words produced per minute by the student during the course of a labeling project. Furthermore, the data indicated that the teachers controlled the frequency of student production of words per minute by the number of opportunities per minute they provided the student.

A student's ability to generalize was discussed in terms of the change in a student's frequency of production and rate of word acquisition as he advanced from one task to a related but different task. The students who generalized by improving their frequency of words per minute from one task to the succeeding related task were provided with an increased number of opportunities. The improvement of students in the area of the ratio of word acquisition was so minimal (less than one word per week) that it was difficult to appraise the students' ability to generalize in terms of their acquiring more words in less time.

The results of the study were insufficient for determining numerical criteria for designing the most efficient language project. However, the major areas to be considered in order to design an efficient language project have been isolated. It is this writer's conclusion that to implement an effective and efficient verbal labeling project based on the application of the ENCOR Language Lattice to Precision Teaching a teacher should first ask herself the following question. What is a reasonable rate at which this student can acquire a maximum number of words in a minimum amount of time while consistently producing words at a maximum frequency of words per minute throughout the duration of the project? The following considerations will help a teacher to answer the question. An efficient project design should include:

1. An initial high number of opportunities.

2. A gradual increase of the number of opportunities for each successive step change.

3. A minimum of one word per week rate of word acquisition for the first task involving labeling of words.

4. An increased rate of words per week with each successive project.

5. Methods to promote carry-over and generalization by providing opportunities for students to employ the words acquired during the teaching time in daily interactions with teachers and parents.

Teacher A came closest to achieving the preceding goals. Her background in speech therapy, her understanding of the lattice and the fact that her students had the highest average mental age all were apparent contributing factors to her successes in implementing the Language Lattice and Precision Teaching. The greatest improvement in her efficiency of project implementation could be made by teacher A decreasing the number of total weeks of step duration in order to increase the ratio of words per week.

The success of teacher B in implementing the Language Lattice and the efficiency with which she designed her language projects is difficult to evaluate due to the fact that data were not available for one of her three students surveyed. Regarding the two students surveyed, teacher B could have improved the efficiency of her project design by increasing the number of opportunities per minute.

Teacher C was successful in assisting her students to achieve a rate of approximately one word acquired per week. Even though her students had a low average mental age compared to the other two groups, they did have the highest average I.Q. Therefore, she could have increased the rate of opportunities per minute and the total number of words presented. By presenting a wider variety of words at a faster rate teacher C may have stimulated the interest of her students, thereby motivating them to learn more words and produce them at a higher frequency of words per minute.

Designing an efficient language project which enhances a student's ability to acquire a maximum number of words in a minimum time span while maintaining a high frequency of words produced per minute is not an easy task. First, the norms have not yet been established which detail either the time required for a moderately retarded child to learn the tasks designated by the Language Lattice and applied to Precision Teaching or the frequency at which a child should be able to perform the tasks. In addition, the process of language acquisition is complex and involves many interacting factors. For example, a teacher must aim for assisting a child to achieve a high ratio of words learned per week without sacrificing a child's current high frequency of production. It is important to look at the entire process rather than one isolated aspect of the process. Initially a child may require more time to acquire the first major step of labeling objects. A high frequency

is initially more important than a high ratio. Once a high frequency is established it may be maintained as the ratio of words acquired per week gradually improves.

Hopefully, the information presented in this study will provide a guide to teachers for designing efficient language projects. Examples of the work of other students may assist a teacher to determine the standards to set for her students and the opportunities to provide them with in order for the students to attain effective language skills in an efficient manner.

People working to teach retarded children to speak must all realize that improvement of the methods is an ongoing process. Through open communication of successes, failures, and insights among people involved in instructing retarded children, progress can be made.

Suggestions for Future Research

It is the writer's suggestion that future studies should be designed which would:

1. Investigate a revision of the Language Lattice to either (a) replace the step "Understanding Adjectives" with a step for combining nouns and verbs into two and three word phrases or (b) add instructions for the teacher to present two expressive programs simultaneously. The additional instruction should include a specified number of words for a teacher to present at each step. For example, teach a student to label ten object words

(nouns) and then ten action words (verbs). Then add a project which combines nouns and verbs in two and three word phrases while simultaneously adding more single object words and action words to the initial projects.

2. Explore methods employed by ENCOR teachers to promote carry-over which could be distributed to all teachers.

3. Establish norms for a moderately retarded child which detail the minimum time required to learn the tasks outlined in the Eastern Nebraska Community Office of Retardation Language Lattice and the maximum frequency at which the students can maintain the production rate of verbal labeling from one step to the next. By maintaining frequency this writer refers to the time of step termination when the frequency will be the same as the frequency at the termination of the previous step.

4. Study the effects of memory span training on a child's learning the tasks described in the Language Lattice. A child's performance for a given task will depend on the length of the phrase or sentence on which he was required to operate in relation to the size of his memory span for that type of task (i.e., imitation) (1:79). Therefore, the addition of memory span training (recalling an increasing number of items in the identical order that they were presented using the auditory, visual, or auditory and visual modalities) may enhance a student's ability to imitate multi-syllable words. The items to be employed

would be consecutive sounds presented by the instructor in a monotone and spaced by two to three seconds. Memory span items could be incorporated into existing projects. For example, for a motor imitation project a teacher could present two or more movements in succession for the student to imitate. The same thing could be done for a sound, sound chain, or word imitation project. Memory span training could consist of an instructor presenting two or more pictures in succession for a student to label.

APPENDIX

SUGGESTED ITEMS FOR VARIOUS LANGUAGE PROJECTS

SUGGESTED ITEMS FOR MOTOR IMITATION* PROJECTS

The instructor says to the student, "Do this," then he illustrates the movement to be imitated by the student.

Level One

Ring bell

Roll ball

Uncover doll

Beat drum

Shake rattle

Stack three blocks

Put peg in hole

Level Two

Raise arm:	Child extends arm so that his hand is over his head.
Clap hands:	Child strikes palms of hands together at least twice.
Hands on head:	Child places one or both hands on top of his head (above the ears at least).
Pats knees:	Child hits both knees with palms of his hands, striking his knees at least twice.

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*Bricker, William A., Personal Consultation. Nashville, Tennessee, February, 1972.

Raise foot:	While seated, child raises one foot at least six inches from a resting position.
Open mouth:	Child parts lips and teeth at least 1/2 inch.
Protrude tongue:	Child protrudes tongue out of his mouth, so that the tip extends about 1/4 inch beyond his lips.

SUGGESTED ITEMS FOR SOUND AND SOUND CHAIN IMITATION PROJECTS

Sounds*

b as in bat

w as in we

m as in man

t as in tan

d as in doe

h as in hat

k as in kite

p as in pot

n as in no

g as in go

s as in sit

f as in fit

r as in rat

l as in leaf

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*Bricker, William A., Personal Consultation. Nashville, Tennessee, February, 1972.

Sound Chains

Combine any consonant sound previously listed with a vowel sound to form a sound chain.

ab as in cab

ba as in bat

bo as in boat

bu as in boot

be as in bee

am as in jam

ma as in mom

mo as in motor

mu as in moo

ta as in table

tu as in two

da as in daddy

pa as in pop

fu as in food

le as in leaf

SUGGESTED WORDS FOR RECEPTIVE AND EXPRESSIVE PROJECTS*

Nouns	Verbs
mommy	eating or eat
daddy	sleeping or sleep
boy	kissing or kiss
girl	running or run
man	walking or walk
bathroom	sitting or sit
bed	jumping or jump
chair	going or go
table	washing or wash
dog	combing or comb
school	playing or play
spoon	working or work
pants	
shoes	
socks	
mouth	Adjectives
hair	big
glasses	little
coat	red

*The words used in this list were chosen from Basic Vocabulary Lists by ENCOR Speech Clinicians and Teachers, Omaha, Nebraska: Eastern Nebraska Community Office of Retardation, April, 1972. (Mimeographed.)

Nouns	Adjectives
car	blue
bus	yellow
wagon	orange
cookie	green
apple	purple

INVENTORY FOR INITIAL ASSESSMENT AND PLACEMENT ON THE LANGUAGE LATTICE

RECEPTIVE SKILLS

____ Reinforcement Preference Established (a child who will not perform a task on command, will perform the task when his correct response is followed by an arranged event.)

Prerequisites

____ Responds to sound

____ Attends

____ Points

____ Matches black and white

Understands Object Words

____ Matches

____ Identifies

____ Generalizes

Understands Action Words

____ Matches

____ Identifies

____ Generalizes

Understanding Adjectives

____ Matches

____ Identifies

____ Generalizes (eight novel pictures depicting the same adjectives.)

EXPRESSIVE SKILLS

Imitates motor movements

____ Level 1

____ Level 2

____ Imitates sounds

____ Imitates sound chains

____ Imitates words

____ Labels object words

____ Labels action words

____ Labels object words

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